PACKET RADIO: An Introduction - - by Larry Kenney, WB9LOZ

Packet Radio is the latest major development to hit the world of Amateur Radio. If you haven't already been caught by the "packet bug", you're probably wondering what it's all about and why so many people are so excited about it. Well, continue reading, because you're about to find out.

Packet seems to offer something different from other facets of Amateur Radio, yet it can be used for everything from a local QSO to a DX contact 2500 miles away (on 2 meters!), for electronic mail, message transmission, emergency communications, or just plain tinkering in the world of digital communications. It presents a new challenge for those tired of the QRM on the low bands, a new mode for those already on FM, and a better, faster means of message handling for those on RTTY. Packet is for the rag chewer, the traffic handler, the experimenter, and the casual operator.

A ham can get involved very easily with relatively small out-of-pocket expenses. All you need is a 2-meter transceiver, a computer or terminal, and a TNC. You probably already have the two meter rig and a computer of some kind, so all you need to buy is the TNC, which costs just over $100. The TNC is the Terminal Node Controller, the little black box that's wired between the computer and the radio. It acts very much like a modem when connecting a computer to the phone lines. It converts the data from the computer into AFSK tones for transmission and changes the tones received by the radio into data for the computer. It's a simple matter of wiring up a plug and a couple jacks to become fully operational.

Packet is communications between people either direct or indirect. You can work keyboard to keyboard or use electronic mailboxes or bulletin board systems to leave messages. Due to the error checking by the TNC, all of it is error free, too. (That is, as error free as the person at the keyboard types it.) As the data is received it's continuously checked for errors, and it isn't accepted unless it's correct. You don't miss the information if it has errors, however, because the information is resent again. I'll go into how this is accomplished in a later part of this series.

The data that is to be transmitted is collected in the TNC and sent as bursts, or packets, of information; hence the name. Each packet has the callsign or address of who it's going to, who it's coming from and the route between the two stations included, along with the data and error checking. Since up to 256 characters can be included in each packet, more than three lines of text can be sent in a matter of a couple seconds. There is plenty of time between packets for many stations to be using the same frequency at the same time, and

all using the same repeater. The repeaters, known as digipeaters, are simplex operations and occupy a single frequency, as opposed to the common two-frequency repeaters used for voice communications. You can link from digipeater to digipeater, too, extending your range tremendously. I've worked twelve states on 2-meters with packet, all with a ten watt rig, thanks to this linking capability.

If all of this sounds confusing, don't let it bother you, because that little black box, the TNC, does everything for you automatically. Packet might seem very confusing at first, but in a day or two you're in there with the best of them. In future parts of this series, I'll be telling you more about packet--how you get on the air, how to use it to your best advantage, and ways to improve your operation. We'll even talk about that little black box, the TNC, and tell you about all its inner-most secrets.

(Thanks to K4CEF and Westlink Report for providing "POINTS TO PONDER ABOUT PACKET - FOR THE NON-PACKETEER" in their November 14, 1986 issue. I've used information from that article in this column.)

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PACKET RADIO: An Introduction - PART II - by Larry Kenney, WB9LOZ

In the first part of this series we told you, in general terms, what packet radio was all about...what it is, its uses, the equipment used and, generally, how its transmitted. Now we're going to tell you how to get on the air, make a QSO, and become familiar with your packet station. Whether you're new to packet, having just received a new TNC, have been involved for just a short time, or are one of the "old timers" with three or four years of experience, this series should help all of you. Even if you don't yet own a TNC, you should keep this article handy for future use. I'll bet you'll be joining us soon!

The equipment needed to get on the air is a VHF transciver, a computer or terminal, and a TNC - the terminal node controller - the little black box we talked about in part 1. (There is packet activity on HF, but VHF is where all the action is. It's the best place to start out in packet.) The TNC contains a modem and is equivalent to the modem used to connect your computer to the phone lines, except that it also contains special software that's specially designed for ham radio packet use.

When you buy a TNC and take it out of the box, you'll find cables supplied for connecting it to the radio, but you'll have to attach the appropriate mic and speaker jack connectors for the radio you're going to use. You also have to furnish the cable that connects the TNC to your computer or terminal. In most cases, the standard RS-232 port is used between the TNC and computer, however this varies on the

type of computer and TNC used. The operating manuals supplied with the TNC have a good write up on the various computers and the cabling needed. I would advise that you read the introduction and set up procedures for your particular TNC very carefully. Most companies have supplied excellent manuals, and you usually can figure out all of your set up problems from the the information supplied in the manual.

Once you have everything wired and connected together, turn on the computer, load a terminal program (anything used for a phone modem will work well for packet) and get into receive mode. Now turn on the radio and make sure the volume is turned up about a quarter turn (about the "10 o'clock" position) and make sure the squelch is set. It should be at the point where the background noise disappers, just as it would be set for a voice QSO. Next, turn on the TNC. You should get a "greeting" or sign on message showing the manufacturer's name, software version, etc. If you see a bunch of gibberish, such as &tf$d.#ssan>m, it means that the data rate of the TNC and computer are not the same. This data rate is better known as the baud rate. The baud rate of the TNC has to match the baud rate used by your computer terminal program and is easily adjusted. Check you TNC manual for this procedure, as it varies from TNC to TNC. If you don't see a "greeting" or the gibberish, check your cables and connections. Make sure that you have everything connected properly, that the right wires are on the right pins, etc.

Now we need to explain the three levels of communicating you can do from the keyboard. First, you can communicate with your computer for setting up the terminal program; second, you can communicate with the TNC; and third, you can communicate with the radio. It's very important that you know which level you're in when working packet. I can't help you much with the computer level, since that varies with manufacturer, model and type, but once you get the terminal program ready to receive data, you're ready to talk to the TNC.

First, do a "control C" (press the CNTL and the letter C simultaneously); this puts the TNC in COMMAND mode, the level where you communicate directly with the TNC from the keyboard. You should see "cmd:" on your screen. Enter "MYCALL - - - -" with your callsign in place of the dashed lines, such as "MYCALL WB9LOZ", followed by a carriage return (CR). All commands are followed by a (CR). This sets into the TNC memory the call that you're going to use on the air. If you type "MYCALL" (CR) now, it should respond with your call. If it does, you've proven that the computer to TNC linkup is working fine. If you do not see anything on the screen when you type, blindly enter the following: ECHO ON (CR). If you see two of everything that you type, such as MMYYCCAALLLL, enter ECHO OFF (CR).

You're now ready to go on the air! Tune the receiver to any odd

numbered frequency between 144.91 and 145.09 that has some activity on it and set the rig up for simplex operation. Enter "MONITOR ON" (CR), then watch the screen. You should soon be seeing the packets that are being sent over the air by other stations. If you don't see anything in a minute or two, try tuning to another frequency. Watch for callsigns with a * next to it, such as W6PW-1*, WA6RDH-1*, or WB6SDS-2*. Callsigns with an asterick indicate that you're copying the packet from that station, as it's being repeated, or digipeated. Jot down the call.

In packet, you can have up to 16 different stations on the air at the same time using the same callsign. That's where the numbers come into play. The calls W6PW, W6PW-1, W6PW-2, W6PW-3, W6PW-4 and W6PW-5 are all individual stations operating under the same station license. The numbers are used to differentiate between the various stations.

Now, before you try to make your first QSO with someone else, you should check out your equipment to make sure it's set up properly. To do that, you can CONNECT to yourself. Note one of the callsigns you jotted down a minute ago. Make sure your radio is still tuned to the frequency where you heard that call, then enter the following: "C - - - - V - - - -" (CR) where the first dashed lines are YOUR callsign and the second dashed lines are the call of the station you jotted down. The C means CONNECT and the V means VIA. "C WB9LOZ V W6PW-1" means connect to WB9LOZ via W6PW-1. You should soon see "*** CONNECTED TO (your call)" on the screen. You have now entered the third level of communications, called CONVERSE mode, and this is where you communicate from the keyboard to the radio. Anything you type on the keyboard will be transmitted over the air as a packet every time you hit a (CR). If you enter "Test" (CR) you should see "Test" a second time on the screen, as it's transmitted, then digi-peated and sent back to you. In this case you'll only be talking to yourself via another station, but it's a good way to check to make sure your system is working properly. If that works, hit a CONTROL C. This puts you back into COMMAND mode where you talk to the TNC again. Enter "D" (CR). This will disconnect you from the other station, and you'll see "DISCONNECTED" on the screen.

Now you're ready to talk to someone else! Watch for a familiar call on the screen while monitoring or note calls you see frequently. Be sure to note whether or not a digipeater is being used by watching for the *. If you see WB9LOZ > WA6DDM, W6PW-1*, for example, you're receiving the packets from W6PW-1. If you do not see an asterick, you are copying the station direct. When the station you want to contact is finished with his QSO, enter "C - - - -" or "C - - - - V - - - -" (depending on whether or not a digipeater is needed) followed by (CR). You should get a "*** CONNECTED TO ..." on the screen, which means you're in converse mode, and your first QSO with someone else is underway! Anything you type now will be sent to the

other station, and anything he types will be sent to you. When you're finished, be sure to do a CONTROL C to get back into command mode, then enter "D" to disconnect from the other station.

You're on the way now to lots of packet fun and adventure!

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INTRODUCTION TO PACKET RADIO - PART 3 by Larry Kenney, WB9LOZ

In our last column I talked about how to get on the air and make your first QSO. This time I'll be explaining the special calls used in packet radio, the use of digital repeaters (called digipeaters), and how to use some of the commands in your TNC.

THE SSID: Each licensed amateur is allowed to have up to 16 different stations in operation at the same time on packet radio. You could have your home station, several digipeaters and a bulletin board system all operating with your callsign. To differentiate between the various operations you use an SSID, a "Secondary Station ID", attached to the end of the callsign. The SSID is shown as a dash followed by a number, 0 through 15. An SSID of -0 is usually not shown, and is not needed.

DIGIPEATERS: Digipeater is the term we use to describe a packet radio digital repeater. Unlike voice repeaters, most digipeaters operate on simplex and do not receive and transmit simultaneously. They receive the digital information, temporarily store it and then turn around and retransmit it.

Your TNC will allow you to enter up to eight digipeaters in your connect sequence, but using more than 3 usually means long waits, lots of repeated packets, and frequent disconnects, due to noise and other signals encountered on the frequency.

When entering the list of digipeaters in your connect sequence, you must make sure that you enter them in the exact order that your signal will use them. You must separate the calls by commas, without any spaces, and the EXACT callsigns must be used, including the SSID, if any. That means you need to know what digipeaters are out there before randomly trying to connect. Turn MONITOR ON and watch for the paths that other stations are using or check the digipeater listings. Here are some examples of proper entries:

```
C W6PW-3 v W6PW-5
C N6ZYX v WA6FSP-1,WB6LPZ-1
C W6ABY-4 v K6MYX,N2WLP-2,AB6XO
```

Something to remember when using digipeaters is the difference between making a connection and sending information packets. If the

path isn't all that good, you might be able to get a connect request through, but will have a difficult time with packets after that. The connect request is short so it has much less of a chance of being destroyed by noise or collisions than a packet containing information. Keeping information packets short can help keep retries down when the path is less than ideal.

NODES: Net/Rom and TheNet nodes are another means of connecting to other packet stations. A complete review of their operation will be covered in a later part of this series.

TNC PARAMETERS: The Terminal Node Controller, that "little black box" we've talked about in the past, has more than 90 different commands available. You're able to customize your packet operating with these commands and turn on and off various features as you wish. Not all TNCs are exactly alike, but all have pretty much the same functions. I'll be using the commands used by the TNC2 and clones in my examples.

We covered a few of the commands in a previous article: CONTROL C for entering command mode, MYCALL, MONITOR, CONNECT, and DISCONNECT. Now let's discuss a few that can change the way your station functions.

ECHO: This command tells the TNC whether or not it should send what you type back to the monitor screen. If you don't see anything when you type, set ECHO to ON. IIff yyoouu sseeee ddoouubbllee, like that, set ECHO to OFF. This setting will depend on how your particular computer system functions.

CONV (converse mode): Your TNC will automatically switch to this mode when you connect with someone, but you can also do it by entering CONV (CR) at the Cmd: prompt. When in converse mode, anything you type will be transmitted via the path you set with UNPROTO. (See the next paragraph.) Anyone in monitor mode will be able to read what you transmit. Packets in converse mode are sent only once and are not acknowledged, so there is no guarantee that they'll get through. This mode is used frequently for sending CQ's.

UNPROTO: This command designates the path used when in converse mode. The default is CQ, but you can enter a series of digipeaters if you wish, or a specific group or club name. Some examples:

```
   CQ v WB6SDS-2,W6SG-1,AJ7L
   SFARC v W6PW-1,W6PW-4
```

Remember, you have to change UNPROTO for use on different frequencies, unless you leave it set simply to "CQ".

FRACK: This determines how long your TNC will wait for an acknowledgement before resending a packet. It shouldn't be set too short, or you simply clutter up the frequency, yet it shouldn't be too long,

or you'll spend too much time waiting. I use FRACK set to 7, and have found that to be an overall good value.

DWAIT: Used to avoid collisions, DWAIT is the number of time units the TNC will wait after last hearing data on the channel before it transmits. I have DWAIT set to 16, and have found that to work well.

PACLEN: Determines the number of characters in your packets, ranging from 1 to 256. The more characters you send per packet, the longer it takes to transmit the information and the greater your chances are of noise, interference or another station wiping it out. I've found a PACLEN of 80, which is the length of one line, to be a good value. When working a station nearby, PACLEN can be increased. When working a distant station, it should be decreased.

RETRY: Your TNC will retransmit a packet if it doesn't receive an acknowledgement from the station you're working. RETRY indicates the number of times the TNC will try to get the packet through before giving up and disconnecting. This can be set from 1 to 15, but I've found 8 to 10 to work well. Less than that causes an unnecessary disconnect if the channel happens to be busy, but more than that clutters up the channel.

Try working with those commands. In the next article I'll cover a few more, plus take a look at how to use a packet bulletin board system.

INTRODUCTION TO PACKET RADIO - PART 4   by Larry Kenney, WB9LOZ

The TNC commands that affect the monitoring mode and what you see on the screen while monitoring will be discussed in this part, then we'll take a look at the basics of packet bulletin board operation.

TNC COMMANDS:
  MONITOR - This must be ON for you to monitor anything. When ON, you see packets from other stations on the frequency you're tuned to. What packets you see is determined by other commands from the list below. If MONITOR is OFF, you see only packets sent to you while you're connected to another station.
  MALL - If MALL is ON, you receive packets from stations that are connected to other stations, as well as packets sent in unproto (unconnected) mode. This should be ON for "reading the mail". If MALL is OFF, you receive only packets sent in unproto mode by other stations.
  MCOM - If ON, you see connect <C>, disconnect <D>, acknowledge <UA> and busy <DM> frames in addition to information packets. If OFF, only information packets are seen.
  MCON - If ON, you see packets from other stations while you're connected to someone else. This can get very confusing, but is

useful when your path is bad and you want to see if your packets are being digipeated okay. If OFF, the monitoring of other stations is stopped when you're connected to another station.

MRPT - If ON, you see a display of all the stations used as digipeaters along with the station originating the packet and the destination station. If OFF, you see only the originating and destination stations. For example, if you have MRPT ON, you might see a transmission such as this:

K9AT>WB6QVU,W6PW-5*: I'll be leaving for the meeting at about 7:30.

If MRPT was OFF, the same transmission would look like this:

K9AT>WB6QVU: I'll be leaving for the meeting at about 7:30.

In the first case, you can see that the W6PW-5 digipeater was being used. The asterick indicates which station you were hearing the packet from. In the second case you have no idea if digipeaters are being used or what station you were receiving.

HEADERLN - If you have this turned ON, the header of each packet is printed on a separate line from the text. If OFF, both the header and packet text are printed on the same line.

MSTAMP - Monitored packets have the date and the time the packet was received if MSTAMP is ON. If it's OFF, the date/time stamp is not shown.

I run my station with all of these commands, except MCON, turned ON so that I can really see what's happening on the frequency I'm monitoring. Try various combinations of these commands and then decide on the combination you like best for your station.

USING A PACKET BULLETIN BOARD SYSTEM:

You connect to a bulletin board system (BBS) exactly the same way as you connect any other station. Once connected, you'll see a welcoming message, some basic instructions and other information. This information will vary from system to system. The first time you connect you'll receive a request to enter your name, home BBS, QTH and zip code for the system user file. You enter your name using the letter N followed by a space and then your first name, such as: N Larry. Your "home BBS" is the system you plan to use regularly and want all of your personal messages delivered to. You enter that by typing NH followed by a space and then the call of the BBS, such as NH W6PW. (Note: SSIDs are not used with BBS operation except for when making the connection. The BBS software ignores all SSIDs.) Your QTH is entered with the NQ command, such as NQ San Francisco, CA. Enter the full city name and the two letter state abbreviation. You enter your zip code with NZ followed by a space and your five-digit zip. The home BBS, QTH and zip code information is sent to a central data bank at the WD6CMU BBS known as the "White Pages", and can be used by anyone. System operators (sysops) use it for determining the correct system when forward messages, and you can use it to find out the "home BBS" of your friends. How to use the "White Pages" will be discussed later on in this series.

When checking in to a BBS for the first time, you should become familiar with the commands available to you. Each BBS or mailbox is a little different from the next, so read the introduction carefully and follow the directions. If you don't know what to do next, enter H for the HELP instructions. Make note of the command letters, enter only one command at a time, and make sure you enter them correctly. Computers are not very forgiving and expect things to be entered in proper form. Take your time, check out the features that the particular BBS or mailbox offers and enjoy yourself. There's no need to feel rushed or intimidated. If you get to a point where you don't know what to do next, don't give up and disconnect, enter H again for HELP. That's what it's there for! I suggest making a printer copy of the complete help file so that you have it available as a reference when using a BBS.

Now let's go through the basic procedures you should follow when checking into a BBS. When you receive the welcoming message, you'll note that the last line ends with a >. This is known as the prompt, and is where you enter the command you want performed next. If there are personal messages addressed to your call, the BBS will list them for you following the welcome message. Note the message numbers.

At the prompt, the first thing you should always do is list the new messages, by entering L. The BBS program updates the user file each time you check in, logging the latest message number. The next time you check in, only new messages that have been received by the system will be included in your list. The first time you'll receive all of them, since they're all new to you. This list can be very long, as many systems have more than 200 active messages on line. When you receive the list, note the numbers of the messages you're interested in reading.

Next, read the messages you're interested in. You do this by entering R XXXX, where the Xs represent the message number, such as R 4521. Note that there is a space between the command and the number. It's best to have your buffer or printer turned on when reading messages, because they're apt to come in faster than you're able to read them. You should have a means of saving them for reading later after you've disconnected. If there were messages addressed to you, you should erase or "kill" them once you've read them. You can do this with the "KM" command, which means "Kill Mine". This command will erase all messages that are addressed to you that have been marked as having been read. You can also kill each message individually by entering K XXXX, where the X's are the message number.

Once you've read all the messages you're interested in, you have several options. You can look back at old messages, send messages to other stations, see what's available in the files section, download a file, upload a file, check the list of stations that have recently checked in to the BBS or stations that have been heard on frequency, monitor other frequencies used by the BBS, use the gateway feature (if available),

check the status of the BBS tasks, or a variety of other things. In part 5 we'll cover some of the other BBS commands. In the mean time, the help file of the BBS should give you all the information you need to try any of the functions mentioned above. Enjoy!

INTRODUCTION TO PACKET RADIO - PART 5 By Larry Kenney, WB9LOZ

In this part of the series, I'll explain how to use the various BBS commands that you have available to you. This information is based on W0RLI software, so it might vary slightly for users of AA4RE, WA7MBL, or other type systems. Use the H - HELP command on your BBS if some of these commands do not work as described.

LIST COMMAND: The first thing you should do when logging on to a BBS is to use the LIST command. There are many variations available, but L, by itself, is the one used most often.

L (List) - Lists all new messages, except other user's personal messages, that have been entered since you last logged in.

If you want to list specific messages, you can use one of the following variations of the L command:

Lx - Lists all messages of the type designated by 'x'. Example: LB will list all bulletins.

L # - Lists messages back to and including number #. Example: L 4050 will list all messages, except personal messages to others, from the latest one back to #4050.

LL #- Lists the last # messages. Example: LL 15 lists the last 15 messages received at the BBS, excluding other's personal messages.

L 1 - Lists ALL non-personal messages.

L> callsign - Lists all messages TO callsign indicated. Example:
L> N6XYZ

L< callsign - Lists all messages FROM callsign indicated. Example:
L< N6XYZ

L@ designator - Lists all messages that have that "designator" in the @ BBS column of the message header. Example: L@ ALLCAN will list all messages with ALLCAN in the @ BBS column.

READ COMMAND: To read a message, you enter R followed by a space then the message number. Example: To read message 5723, you'd enter: R 5723. You also have the option of using the RH command, which will give you all of the forwarding headers in detail, rather than just giving you the path. Example: To read message 5723 with the full headers, you'd enter RH 5723.

There is one other version of the READ command, and that's RM. Entering RM by itself will give you all of the messages addressed to you that have not yet been read.

ERASING MESSAGES: Once you have read a personal message, please erase it. The sysop will appreciate your help in clearing up "dead" messages. You use the K - KILL command to do this. You can enter

K #, such as K 5723, which will erase that particular message, or you can enter KM, which will erase all of the personal messages you have read. If you use the KM command, the BBS will list the message numbers for you as they're killed.

THE DUAL PURPOSE "S" COMMAND: S (Status) and (Send) - The letter S by itself will give you a reading of the BBS status, showing the callsigns of stations using the system, the time they connected, the port used, etc. It also shows information on the message and user files.

The "S" command is also used for sending a message, but it must be further defined. There are three types of messages found on a packet bulletin board system: Personal, Bulletin, and Traffic. "SP" is used for sending a personal message to one other station, "SB" for sending a bulletin, and "ST" for sending a message that's going to be handled by the National Traffic System.

You're able to send a message to one particular person, to everyone on the local BBS, to everyone at every BBS and mailbox in Northern California, in Southern California, in the entire state, or all across the entire country. It all depends on your addressing.

At the BBS prompt you enter the appropriate command (SP, SB, or ST) followed by a space and then the addressee. The addressee can be a callsign or it can be something of a general nature, such as ALL, QST, ARES. Examples: SP WB9LOZ SB ALL. All commands, of course, must be followed by a <CR>.

If you wish to send the message to someone at another BBS, you have to indicate the call of the other BBS following the call of the addressee. For example, to send a message to N5PQ, who uses the W5XYZ BBS, you would enter: SP N5PQ @ W5XYZ.

To send a general message to more than just the local BBS, you need to use a designator in place of the BBS call. The designator indicates the area where you want the message distributed. ALLCAN indicates that you want the message sent to all Northern California BBSs, which includes all of them from Santa Cruz, Hollister, Gilroy, and Fresno northward. ALLCAS will send the message to all BBSs in the southern part of the state. A message that's sent @ ALLCA will go to EVERY BBS in the state, and a message sent @ ALLUS will be sent to EVERY BBS IN THE USA. Extreme care should be used when using the ALLUS designator. Please make sure that the subject matter is of interest to EVERY packet user and please keep the message SHORT. The National HF Packet Network is somewhat fragile, due to band conditions, so unnecessary traffic can keep more important traffic from getting through. Here are a few examples of addressing bulletin-type messages for general distribution: SB ALL @ ALLCAN SB ALL @ ALLCA

SB QST @ ALLCAS SB ALL @ ALLUS

If you have traffic for the National Traffic System, you must use a special format. NTS messages are entered as ST ZIPCODE @ NTSXX, where XX is the two-letter state abbreviation. Examples:

ST 03452 @ NTSNH ST 60626 @ NTSIL

NTS traffic for California locations do not need the NTSCA. Simply enter ST 90028 or ST 94101, for example. (You'll find more details on NTS traffic handling in a later part of this series.)

When you have the address line complete, you enter a carriage return. You'll then receive a prompt asking for the SUBJECT or TITLE of the message. Enter a brief description of what the message will be about, followed by a carriage return. Next, you'll be prompted to enter the TEXT of the message. When entering the text, you should insert carriage returns at the end of each line, as if you were typing a letter. A normal line has a maximum of 80 characters, so when you have 70 to 75 characters typed, enter a carriage return and continue on the next line. This will prevent words from wrapping around to the next line and the program inserting an unnecessary blank line in the text.

When you have your message complete, you end it with a CONTROL Z. (You send a CONTROL Z by holding down both the CONTROL key and the Z key simultaneously.) You should follow the CONTROL Z with a carriage return. When you receive the BBS prompt back, you'll know that the message has been accepted by the system.

FILE DIRECTORY COMMANDS:

W (What) - Entering W, by itself, gives you a list of the directories available on the BBS.

Wd - Gives a list of the files in the directory indicated by d. The list you obtain with the W command will indicate what letter to use for "d" to list the files of specific topics.

D (Download) - Used for reading files from a directory. Must be used with a directory ID and filename using the following form:

Dx filename. x is the directory ID and the filename must be entered exactly as listed in the directory. Again, the directory ID is obtained from the list you receive with the W command. Example: DG FCCEXAMS.88

U (Upload) - Used for uploading (sending) a file to the BBS. The command must be used with a directory ID, followed by the filename you're assigning to the file, using the form: Ud filename. The d indicates the ID of the directory where you want to enter the file. Filenames can have up to 8 characters preceding the dot and 3 characters following the dot. Example: UM FLEAMKT.INF would upload a

file named FLEAMKT.INF into the directory with the M ID. The BBS program will not allow you to upload a file with a filename that already exists, and some directories are set by your local sysop for downloadiing only.

GENERAL MISCELLANEOUS COMMANDS:

I (Info) - Gives you details on the hardware, software and RF facilities of the BBS you're using.

J - Displays a listing of stations that were heard by the BBS or that connected to the BBS. Must be used with a port identifier, such as JA, JB, etc. J by itself will list the port IDs for you.

M (Monitor) - Used for monitoring the activity on another port of the BBS. Must be used with a port identifier, such as MA, MB, etc. M by itself will list he port IDs.

B (Bye) - When you're finished using the BBS, you enter a B to disconnect.

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In part 6 of this series, the topic of discussion will be NET/ROM.

73, Larry, WB9LOZ

INTRODUCTION TO PACKET RADIO - PART 6 - By Larry Kenney, WB9LOZ

In this part of the series we're going to take a look at how to use NET/ROM and THENET for making contacts. It's a way of making your operating time on packet more enjoyable due to the increased reliability of the network and the greatly expanded area that you can reach.

When a digipeater adds NET/ROM or THENET it becomes a digipeater/node. This means that you can still use it as a regular digipeater, but you can also use it to access a far reaching network of nodes. When using a string of digipeaters, your packets have to reach their destination parity correct, and the receiving TNC has to return an acknowledgement (ack) to your TNC for each packet cycle to be completed. As you add more digipeaters to the string, the chances of this happening become less and less. Other stations on the frequency and noise can be the cause of many retries. When using a node, your packets no longer have to reach their destination before acknowledgements are returned to your TNC. Now, each node acknowledges your packet as its sent along the way toward its destination.

Here's how you use the nodes network: No matter what station you want to work, you connect to the closest node. When you connect, your TNC

automatically switches to converse mode, so anything you now type is sent to the node as a packet, and the node acknowledges each packet back to your TNC. For the remainder of your connection your TNC works only with this node.

Once you're connected to the node, enter "NODES" <return> and you'll receive a list of the other nodes available to you. It's sometimes difficult to determine the location of the nodes from this list, since the IDs and callsigns you receive aren't always very descriptive. You might find the node maps and listings that are available on most packet bulletin boards to be useful tools. With these maps and listings, you can easily determine where the nodes are located. Make sure you have a recent copy, as new nodes are being added quite frequently.

Let's say you want to have a QSO with N6XYZ. You first must determine what node is closest to that station. Let's say it's W6AMT-3. Once you know the call of that node, you connect to it WHILE STILL CONNECTED TO YOUR LOCAL NODE. You use standard protocol, C W6AMT-3. Your TNC will send this as a packet to your local node, and your local node will ack it. Your TNC is happy because the cycle is completed as far as it's concerned. The network will then go to work for you and find the best path between your local node and the one you're trying to reach. You'll then see one of two responses: "Connected to W6AMT-3" OR "Failure with W6AMT-3". If it can't connect for some reason, try again later. It could be that W6AMT-3 is temporarily off the air or the path has decayed and is no longer available. We're going to be positive here and say we received the first option.

Now that you're connected to W6AMT-3, enter "C N6XYZ". Again, your TNC will send this as a packet to your local node and the node will acknowledge it and send it down the path to W6AMT-3. W6AMT-3 will then attempt to connect to N6XYZ. Here again you'll get one of the two responses: "Connected to N6XYZ" OR "Failure with N6XYZ". If you get connected, you hold your QSO just as you normally would, but there's one BIG difference -- your TNC is receiving acknowledgements from your local node, and N6XYZ is receiving acknowledgements from W6AMT-3. That long path is eliminated for both TNCs, retries are greatly reduced, and your packets get through much faster. When you're finished with the QSO, you disconnect in the normal manner -- go to Command Mode using Control C and enter "D" <CR>. The entire path will then disconnect automatically for you.

If you've been monitoring lately, you might have seen the nodes in action and wondered why they were sending all of those weird symbols like @fx/<~|. What you're seeing is the nodes communicating with each other, updating their node lists. You also might have noted callsigns with high numbered SSIDs, such as WB9LOZ-15, WA6DDM-14, W6PW-12, etc. The nodes change the SSID of all stations so that the packets sent via the network are not the same as those sent directly. If you were to use a node to connect to another station in the local area, there's the possibility of your packets

being received at this station both from you directly and from the node. If the call through the node wasn't changed, the TNCs involved would be totally confused as it would appear that two stations were connecting using the same callsign. The node automatically changes the SSID using the formular 15-N, where N is your usual SSID. A call with -0 becomes -15, a -1 becomes -14, -2 becomes -13, etc.

In part 7 of this series, I'll discuss some of the other commands available to you on the nodes, including how to call CQ.

INTRODUCTION TO PACKET RADIO - Part 7 - by Larry Kenney, WB9LOZ

The network of NET/ROM, THENET and KAM nodes is expanding very quickly and now covers most of the country. New nodes are showing up almost daily. Thanks to all of these new stations and the interconnecting links, you can now connect to stations in many far distant places using your low powered 2 meter rig. Some nodes are set up for cross-banding, and with the introduction of nodes on 10 meter FM, there's the possibility of working a station just about anywhere.

A complete listing of NET/ROM NODES is available on most BBSs, as well as maps showing how everything is tied together. The lists are updated frequently by Scott, N7FSP, in San Jose.

NET/ROM is very simple to use, and I understand that THENET and KAM nodes are very similar. As explained in part 6 of this series, to use NET/ROM, you first connect to a local node. You then have several options -- connect to another station within range of the node, connect to another node, obtain a list of the nodes that are available, check user status, or answer or call CQ.

There are only FOUR commands to remember to use the system: CONNECT, NODES, USERS and CQ. The CONNECT command (which can be abbreviated as C) works just like the CONNECT command in normal usage, except that you can connect from one node to another. For example, you can CONNECT to W6AMT, and then do another CONNECT to WA6RDH-1, another node. Let's go through a simple connection via NET/ROM. Say I want to connect to a friend in Reno, within reach of WA7DIA-1, a node in the Sierras. I would first connect to my local node, say W6AMT, then connect to WA7DIA-1, then connect to my friend. Here's what it would look like:

C W6AMT
Connected to W6AMT
C WA7DIA-1
SFO:W6AMT} Connected to RNO:WA7DIA-1
C K7ZYX
RNO:WA7DIA-1} Connected to K7ZYX

You then conduct your QSO, and disconnect in the normal manner. (Go to command mode on your TNC and enter a D.) One disconnect command will disconnect you from the entire network.

You'll note that many of the nodes have aliases, such as SFO for W6AMT, VACA for WA6RDH-1, SSF1 for KA6EYH-1, etc. With NET/ROM, you can connect to the alias identifier, so "C SFO" would work as well as "C W6AMT".

Once connected to a node, the other commands come into play. The NODES command (which can be abbreviated as N) will give you a listing of other nodes available from the node you're connected to. The USERS command (which can be abbreviated as U) will show you the calls of all the stations using the node you're connected to. The CQ command (which cannot be abbreviated) is, of course, used for calling CQ, but also can be used for replying to the CQ of another station. The CQ command is available only in NET/ROM version 1.3.

There are two other commands, but they're used for status information only. IDENT will simply give you the identification of the node you're on, and PARMS (Parameters) is for the owner's use in determining how his station is working.

Using the NET/ROM CQ Command: The CQ command is used to transmit a short text message from a node, and is also used to enable stations that receive the transmission to connect to the station that originated it. The command is:

  CQ [textmessage]

The "textmessage" is optional and can be any string up to 77 characters long (blanks and punctuation are allowed). In response to a CQ command, the node transmits the specified textmessage in "unproto" mode, using the callsign of the originating user with a translated SSID as the source and "CQ" as the destination. For example, if user station W6XYZ connects to a node and issues the command: "CQ Anybody around tonight?", the node would then transmit

"W6XYZ-15>CQ: Anybody around tonight?"

After making the transmission in response to the CQ command, the node "arms" a mechanism to permit other stations to reply to the CQ. A station wishing to reply may do so simply by connecting to the originating call-sign shown in the CQ transmission (W6XYZ-15 in the example above). A CQ command remains "armed" to accept replies for 15 minutes, or until the originating user issues another command or disconnects from the node.

Any station connected to a node may determine if there are any other stations awaiting a reply to a CQ by issuing a USERS command. An "armed" CQ channel appears in the USERS display as:

  (Circuit, Host, or Uplink) <~~> CQ(usercall).

The station may reply to such a pending CQ by issuing a CONNECT to the user callsign specified in the CQ(...) portion of the USERS display--it is not necessary for the station to disconnect from the node and reconnect. Here's what a typical transmission would look like:

  cmd: C KA6YZS-1

```
cmd: *** Connected to KA6YZS-1
USERS
501SJC:KA6YZS-1} NET/ROM 1.3 (669)
Uplink(WB9LOZ)
Uplink(K1HTV-1)            <~~>  CQ(K1HTV-14)
Circuit(LAS:K7WS-1 W1XYZ)  <~~>  CQ(W1XYZ-15)
Uplink(N4HY)
CONNECT W1XYZ-15
501SJC:KA6YZS-1} Connected to W1XYZ
Hi!  Thanks for answering my CQ.
etc.
```

Users of the CQ command are cautioned to be patient in waiting for a response. Your CQ will remain "armed" for 15 minutes, and will be visible to any user who issues a USERS command at the node during that time. Wait at least five minutes before issuing another CQ--give other stations a chance to reply to your first one!

NOTE: As mentioned above, the CQ command was introduced in NET/ROM version 1.3. On a node using an earlier version, you will get the message "Invalid command". The USERS command can be used to determine which version a node is using as shown in the example above. If you cannot initially connect to a node using version 1.3, that doesn't stop you from using the CQ command. Once you're connected to a node you can reach, simply connect to one that has version 1.3.

Give the new CQ feature a try. You might work someone locally, in Phoenix, Seattle, or on the East Coast. You never know where you'll get connected to next! Enjoy!

(Material distributed by Scott, N7FSP, was used in the preparation of this part of the series.)

INTRODUCTION TO PACKET RADIO - PART 8 by Larry Kenney, WB9LOZ

The National Traffic System, known as NTS, is the ARRL sponsored Amateur Radio message handling network. Packet radio is now playing a very important part in the network, so we're going to look at the system and give you some tips on handling NTS traffic by packet.

Handling third party traffic is the oldest tradition in amateur radio. This is most valuable during disasters. Nationwide, the National Traffic System has hundreds of local and section nets meeting daily in order to facilitate the delivery and origination of such messages. More and more of this traffic is being originated, relayed, and delivered on packet. If you enjoy traffic handling, you can easily get involved in NTS via packet. If you're on packet but know nothing about NTS, this part of the series can get you off to a good start. At the end of this part, you'll find some references for further information.

Local packet BBSs have to be checked daily for traffic that needs to be delivered or relayed. When you check into your local BBS, enter the LT command, meaning "List Traffic". The BBS will sort and display a list of all NTS traffic awaiting delivery. It'll look similar to this example:

```
MSG# STAT SIZE TO     FROM   @BBS   DATE/TIME SUBJECT
7893 T     486 60625  KB6ZYZ NTSIL  1227/0712 QTC1 CHICAGO, IL 312-267
7802 T     320 06234  K6TP   NTSCT  1227/0655 QTC1 NEW HAVEN, CT
7854 T     588 93432  KA4YEA        1227/0625 QTC1 CRESTON, CA 93432
7839 T     412 94114  KK3K          1227/0311 QTC1 SAN FRANCISCO 415-821
7781 T     298 94015  W1KPL         1226/2356 QTC1 DALY CITY, CA 415-992
```

You might see traffic that is being relayed by your local BBS to some other part of the country as well as traffic for your local area. The "Subject" or "Title" column of the listing will show the destination of the traffic. If you see a message that is within your local area, help out and deliver it.

RECEIVING A MESSAGE: To take a message off of the Bulletin Board for telephone delivery, or for relay to a local NTS net, enter R followed by the message number. Using the list above, R 7839 would send you the message from KK3K for San Francisco. You'll find the message in a special NTS RADIOGRAM format, with a preamble, address, telephone number, text and signature, ready for delivery. After the message has been saved to your printer or disk, the message should be erased from the BBS. You use the KT command, which means "Kill Traffic", followed by the message number. In this case you would enter KT 7839 to erase the message you took from the BBS. This prevents the message from being delivered again by someone else.

DELIVERING OR RELAYING A MESSAGE: Once you have received the NTS Radiogram, it should, of course, be handled expeditiously. If it's for your immediate area, you should deliver the message by telephone. If you took the message for delivery to the local traffic net, you should make an effort to see that it gets relayed as quickly as possible.

SENDING MESSAGES: Any amateur can originate a message on behalf of another individual, whether the person is a licensed amateur or not. It is the responsibility of the originating amateur, however, to see that the message is in proper form before it's transmitted. A special format is used for NTS traffic, so that the messages are compatible across the entire network. Each message originated and handled should contain the following components in the order given: number, precedence, handling instructions (optional), the station of origin, check, place of origin, time filed, date, address, telephone number, text and signature. You should check the ARRL publications or your local BBS for details on message preparation.

When the message is ready to be entered into your local BBS, you must use the ST command, which means "Send Traffic", followed by the zip code of the destination city, and "NTS" followed by the two letter state abbreviation. The form used is ST Zipcode @ NTSxx. A message being sent to Boston, MA 02109 would be entered as follows: ST 02109 @ NTSMA and a message for Iowa City, IA 52245 would be entered as ST 52245 @ NTSIA. The message SUBJECT or TITLE should contain "QTC 1" followed by the destination city and state and the telephone area code and exchange, if available. See the examples in the listing above. Only one NTS message should be included in each packet message. The actual radiogram should be included entirely within the TEXT of the packet message, including all of the components listed above. End the message with the usual Control-Z.

IN TIME OF EMERGENCY: The National Traffic System functions on a daily basis as a positive public service for both your fellow hams and the general public. It serves another function as well. The NTS provides a well oiled and trained national system of experienced traffic handlers able to handle large volumes of third party traffic accurately and efficiently during disasters. At least that is the goal. The ARRL booklet "An Introduction to Operating an Amateur Radio Station" offers detailed information on handling and preparing NTS Radiograms and the files section of your BBS should have instructional files on NTS. You should find files such as "Delivery.NTS", "Howto.NTS", "Whatis.NTS", as well as several other helpful files. Check them out if you want to get involved. Your help will be welcome!

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Thanks to the April, '87, "ARRL Field Forum" and Don Simon, NI6A, for help in preparing this article.

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Next, we take a look at some of the special commands available to you in your TNC and take a close look at the BBS message format.

INTRODUCTION TO PACKET RADIO - PART 9 - by Larry Kenney, WB9LOZ

In this part of the series I'll explain, in detail, the various parts of the packet message. The following is an example of what you see when listing or reading messages on a BBS. On some systems, the information is displayed in a different order.

```
MSG# STAT SIZE TO     FROM   @ BBS  DATE/TIME SUBJECT
4723 P    1084 WD5TLQ WA6XYZ N5SLE  0604/1240 Software working great!
```

The message number is assigned by the BBS program when the message is entered and cannot be changed. The numbers are assigned sequentially.

Next you find the STATUS of the message which includes several different bits of information about the message.

The first letter of the STATUS indicates the TYPE of message: B for Bulletin, P for Personal, or T for Traffic for the National Traffic System. Bulletins are messages of general interest to all users, and are available to be read by everyone using the system. Personal messages are not listed for anyone except the sender and the addressee, and only they can read them. (Of course, anyone in monitor mode can see a message of this type as it's being sent, because nothing on packet is absolutely private.) Traffic messages, type T, are messages used for handling traffic on the National Traffic System. (Refer to part 8 of this series for information on NTS.)

STATUS also shows if the message has been read, has already been forwarded to all designated stations, is in the process of being forwarded, or is an "old" message. You might see one of these letters: Y - yes, it has been read, F - it has been forwarded, I - it's in the process of being forwarded right now on another port, or O - the message has been on the BBS long enough to become an "old" message. "Old" can be anywhere from 2 days for an NTS message to 3 weeks for bulletins. The time frame for each message type is specified by the local sysop. The "O" is mainly used to catch the attention of the sysop.

The SIZE indicates the combined total of characters, including punctuation in the message.

TO, normally, is the callsign of the addressee, but it is also used to categorize messages on particular topics. You might find a message addressed TO AMSAT, TO PACKET or TO ARRL, when it is actually a message about AMSAT, about PACKET or having to do with the ARRL.

FROM shows the callsign of the station originating the message.

@ BBS is used if you want a message to be forwarded to someone at another BBS or to a specific designator. In the example, the message would be automatically forwarded to WD5TLQ at the N5SLE BBS. You can enter special designators, such as ALLCAN, in the "@ BBS" column for multiple forwarding to specific areas. (See Part 5 of this series for details on using forwarding designators.)

Next is the DATE and TIME when the message was received at the BBS. Keep in mind that the date and time are shown in the time used by the BBS, and can be either local time or Zulu.

The SUBJECT (or TITLE) is a short line telling what the message is all about. It should be brief, but informative. For bulletin type messages, this is the information that determines whether or not a person is going to read your message when he sees it in the message list.

The parts of the message mentioned so far are all included in the header of the message, and are seen when listing messages. The remaining parts are in the body of the message, and are seen only when the message is read.

If a message has been forwarded from another BBS, you'll see forwarding headers at the top of the actual message. This is information added by each BBS that was used to get the message from its origination point to the destination. Each BBS adds one line showing the time the message was received by that particular BBS, its call sign, and usually the QTH, zip code, and message number. Other information is often added, at the discretion of the sysop there. If you use the RH command, rather than just R, when reading a message, such as RH 7823, you'll receive complete headers. With just the R, headers are reduced to a list of the BBS callsigns. Complete headers are useful if you want to determine how long it took a message to be forwarded from the source to destination, and they can be used to determine the path the message took to reach you.

The TEXT of the message contains the information you want to convey to the reader. It can be of any length. When entering a message into a BBS, use carriage returns at the ends of your lines, as if you were using a typewriter. Do not allow the automatic wrapping of lines to occur. A message entered without carriage returns is very difficult to read, as words are cut at improper points, lines vary drastically in length, and blank lines are often inserted.

You complete the text with either a Control-Z or these three characters: the "slash" (/) plus the letters "EX". On some BBSs this must be on a line by itself. This tells the system that you've finished entering the message.

Messages that are going to be forwarded to several BBSs or across a long distance should be limited in size. Extremely long messages can tie up the forwarding system unnecessarily, so users are advised to break up long messages into parts, keeping them to a length of 2 - 3 K each.

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(In the next part of this series, we'll be discussing tips on how to make your packet operating time more enjoyable.)

INTRODUCTION TO PACKET RADIO - Part 10 - by Larry Kenney, WB9LOZ

Here are some tips to help make your packet operating a little more enjoyable. Whether it's while making local QSOs, checking into a BBS or mailbox, or working DX, there are a few things you should take into consideration that will help eliminate waiting time and increase your throughput.

When connecting to another station, don't use a digipeater unless you have to. Each digipeater you add to the chain increases the time required to get your signal to its destination and to get an acknowledgement returned. It also increases the chance for interference and for collisions with other packets. You'll be amazed at the difference in throughput when comparing a direct connect to one with just one digipeater in the path.

Also, if you have a choice, use a frequency that doesn't have a lot of other traffic on it. It makes sense that the more stations there are on frequency, the more chances there are for collisions and retries. A path that will work perfectly without a lot of traffic, can become totally useless under heavy traffic conditions.

Dr. Tom Clark, W3IWI, has determined that for EACH HOP, the loss of packets can vary anywhere from 5% to 50% depending on the amount of traffic. Remember, each digipeater and node adds a hop, so multiply those percentages by the number of hops, then multiply by 2 to account for the acknowledgement, and you can see how quickly the path deteriorates as traffic increases and digipeaters and nodes are added to it.

Another consideration, especially if working over a long distance, is atmospheric conditions. You might not have experienced this before on VHF, but with packet's high sensitivity to noise, a slight change in signal strength can mean the difference between getting your packets through or not getting them through. An example of one path that is very vunerable to conditions due to its distance is from W6AK-1 on Mt. Vaca to WB6AIE-1 on Bald Mountain in Yosemite National Park on 145.05 MHz. Most of the time, packets go between these two digipeaters without any problem, but there are times, especially when it's a hot summer day in the Sacramento Valley, when it's impossible to get a packet from one to the other. In the Bay Area, the fog has a drastic affect on VHF signals. When a fog bank is moving in off the Pacific, it can act as an excellent reflector. Signals that are not normally heard can reach signal strengths of 40 over S9.

NET/ROM, TheNet, and KA-Nodes, as discussed in previous articles in this series, do a great deal to help you get your packets through, but you must remember that they, too, are affected by the number of hops, the traffic load and the atmospheric conditions between you and the destination station. The big advantage to NET/ROM is that the acknowledgements do not have to return all the way from the destination station. Packets are acknowledged from node to node, so that eliminates a large part of the problems encountered. Getting the original packet through, however, remains to be as much of a problem for the nodes as it is for you when using digipeaters.

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In the next part of this series we take a look at some of the more obscure TNC commands and how you use them.

73, Larry, WB9LOZ

INTRODUCTION TO PACKET RADIO - Part 11 - by Larry Kenney, WB9LOZ

In this part of the series we'll take a look at many of the TNC commands available to you that we haven't covered in previous articles. We will be discussing the commands used in the TAPR TNC2 and TNC2 clones. You might find that some of the commands are not available in your particular TNC or that they're used in a slightly different manner than the one explained here. Please refer to your owner's operating manual for specific details on how to use these commands in your TNC.

8BITCONV: This command enables the transmission of 8-bit data in converse mode. Used with AWLEN - see below.

For normal packet operation, such as keyboard to keyboard transmissions, use of bulletin boards, and transmission of ASCII files, 8BITCONV should be OFF. If you need to transmit 8-bit data, set 8BITCONV ON and set AWLEN to 8. Make sure that the TNC at the receiving end is also set up this way. This procedure is normally used for transmission of executable files or a special non-ASCII data set.

AWLEN: This parameter defines the word length used by the serial input/output port of your TNC.

For normal packet operation, as described above, AWLEN should be set to 7. Set to 8 only if you're going to send 8-bit data.

AX25L2V2: This command determines which level of AX.25 protocol you're going to use.

If OFF, the TNC will use AX.25 Level 2, Version 1.0.
If ON, the TNC will use AX.25 Level 2, Version 2.0.
Some early TNCs will not digipeat Version 2.0 packets.
Version 2.0 has added features. See the CHECK command below. Many operators have suggested that Version 2.0 NOT be used on the HF bands as it tends to clutter the frequency.

BEACON: Used with EVERY or AFTER to enable beacon transmissions.
BEACON EVERY n - send a beacon at regular intervals specified by n.
BEACON AFTER n - send a beacon once after a time interval specified by n having no packet activity.
n = 0 to 250 - specifies beacon timing in ten second intervals. 1 = 10 seconds, 2 = 20 seconds, 30 = 300 seconds or 5 minutes, 180 = 1800 seconds or 30 minutes, etc.

For example, if you set BEACON EVERY 180 (B E 180), the TNC will transmit a beacon every 30 minutes. If you set BEACON AFTER 180 (B A 180), the TNC will transmit a beacon after it hears no activity

on the frequency for 30 minutes. B E 0 will turn the beacon off. The text of the beacon is specified by BTEXT and can contain up to 120 characters. The path used for the beacon transmission is specified by the UNPROTO command. YOU SHOULD USE BEACONS INTELLIGENTLY! Beacons are often a point of controversy in the packet community because they tend to clutter the frequency if used too frequently. You should keep your beacons short and infrequent, and they should only be used for meaningful data. Bulletin boards use the beacon for advising the community of who has mail waiting for them, clubs use beacons for meeting announcements, beacons are used for weather warnings, etc.

CHECK n Sets a timeout value for a packet connection. Operation depends on the setting of AX25L2V2. The value of CHECK (n) determines the timing. Value may be 0 to 250. Check set to 0 disables the command.

If a connection between your station and another exists and the other station seems to "disappear" due to changing propagation or loss of an intermediate digipeater, your TNC could remain in the connected state indefinitely. If the CHECK command is set to a value other than 0, the TNC will attempt to recover. The setting of AX25L2V2 will determine what action is taken.

If AX25L2V2 is ON, the TNC will send a "check packet" to verify the presence of the other station if no packets have been heard for n * 10 seconds. (n = 1 = 10 seconds, n = 5 = 50 seconds, n = 30 = 5 minutes, etc.) If a response is received, the connection will remain. If no response is received, the TNC will begin the disconnect sequence, just as if the DISCONNECT command had been sent.

If AX25L2V2 is OFF, after no packets are heard for n * 10 seconds, the TNC will not send a check packet, but will begin the disconnect sequence.

CMSG Enables the automatic sending of a connect message whenever a station connects to your TNC.

If CMSG is ON, the TNC will send the message contained in CTEXT as the first packet of the connection. CTEXT can contain up to 120 characters. This feature is often used when the station is on but the operator is not present. The connect message is used to advise the other station of that fact, and often says to leave a message in the TNC buffer. If CMSG is off, the text message is not transmitted.

MAXFRAME Sets the upper limit on the number of unacknowledged packets the TNC can have outstanding at any time. (The outstanding packets are those that have been sent but have not been acknowledged.) It also determines the maximum number of contiguous packets that can be sent during one transmission. Value can be set from 1 to 7.

The best value of MAXFRAME depends on the frequency conditions. The better the conditions are, the higher the value you can use. If

conditions are poor due to the amount of traffic on the frequency, noise, or other variables, (shown by lots of retries) MAXFRAME should be reduced to improve throughput. The best value of MAXFRAME can be determined through experimentation. MAXFRAME of 1 should be used for best results on HF packet.

MHEARD An immediate command that causes the TNC to display a list of stations that have been heard since the command MHCLEAR was given or the TNC was powered on.

This command is useful for determining what stations can be worked from your QTH. Stations that are heard through digipeaters are marked with an * on most TNCs. On the AEA PK-232, the stations heard direct are marked with the *. (Check your TNC manual.) The maximum number of stations in the list is 18. If more stations are heard, earlier entries are discarded. Logging of stations heard is disabled when the PASSALL command is ON. If the DAYTIME command has been used to set the date and time, entries in the MHEARD list will show the date and time the stations were heard.

PASSALL Causes the TNC to display packets that have invalid checksums. The error-checking is disabled.

If PASSALL is ON, packets are accepted for display, despite checksum errors, if they consist of an even multiple of eight bits and are up to 330 bytes. The TNC attempts to decode the address field and display the callsigns in standard format, followed by the text of the packet. PASSALL can be useful for testing marginal paths or for operation under unusual conditions. PASSALL is normally turned OFF.

SCREENLN n This parameter determines the length of a line of text on the terminal screen or platen. Value may be 0 to 255.

A (CR-LF) carriage return and line feed are sent to the terminal in Command and Converse modes when n characters have been printed. A value of zero inhibits this action. If your computer automatically formats output lines, this feature should be disabled.

TXDELAY n This parameter tells the TNC how long to wait before sending data after it has keyed the transmitter.

All transmitters need some start up time to put a signal on the air. Some need more, some need less. Synthesized radios and radios with mechanical relays need more time, while crystal controlled radios and radios with diode switching require less time. External amplifiers usually require additional delay. Experiment to determine the best value for your particular radio.

TXDELAY can also be useful to compensate for slow AGC recovery or squelch release times at the distant station.

There are many additional commands available to you. I've only covered the ones that I thought would be the most useful to you. Spend some time reading the owner's operating manual that came with

your TNC to discover some of the surprises the other commands offer. New versions of the TNC software have added several commands that you might find useful in your packet operating.

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INTRODUCTION TO PACKET RADIO -- Part 11 - Addendum
by Larry Kenney, WB9LOZ

Scott, N7FSP, has offered further information on the AX25L2V2 TNC command mentioned in part 11. He also suggests that with NET/ROM and TheNet nodes sending characters that clear your screen, ring bells, and make your cursor jump all over the place, that I pass on information on the MFILTER command. I agree, and the information follows.

First, Scott's information on AX25L2V2:

With AX25L2V2 OFF, if your TNC sends a packet and the packet doesn't get acknowledged the first time it was sent, it will send it again and again, until an "ack" is received or the TNC retries out.

With AX25 ON, if your TNC sends a packet and doesn't receive an "ack" the first time, it will send a poll frame to see if the other TNC received the packet. If yes, then it would continue, if not then it would send the last packet again. The advantage here is that short poll frames are sent, rather than long packets containing data. This can greatly reduce channel congestion. For VHF/UHF operation, it is almost essential that every TNC have AX25L2V2 ON.

MFILTER This command allows you to enter up to six ASCII character codes, 0 - $7F, for the control characters that you want eliminated from your monitored packets. Codes may be entered in either Hex or Decimal.

Here are the ASCII codes for some of the more troublesome control characters found in monitored packets:

HEX	DEC	FUNCTION	POSSIBLE RESULT
$07	07	Control G	Rings your bell or "beeps" your speaker
$0C	12	Control L	Form feed - could clear your screen
$13	19	Control S	Can cause your screen to stop scrolling
$1A	26	Control Z	Can clear your screen
$1B	27	Escape	Can cause your cursor to move to a random point on your screen and can raise havoc with printer control.

AEA has added a new code, $80, that will not allow ANY control characters to be displayed on the user's screen from monitored

packets.

(Thanks to N7FSP for the added information and the suggestion.)
INTRODUCTION TO PACKET RADIO -- Part 12
by Larry Kenney, WB9LOZ

In this article we're going to look at the White Pages. Not your local telephone directory, but the packet radio directory known as "White Pages". You help supply the information for "WP", and you can also use it to find the home BBS, QTH and zip code of your friends on packet.

"White Pages" was initially designed by Eric Williams, WD6CMU, of Richmond, California. It's a database of packet users showing their name, home BBS, QTH and zip code. It's updated and queried by packet message, allowing stations from all over the world to take advantage of it. Hank Oredson, W0RLI, later added a WP feature to his packet bulletin board software. As users enter their name, home BBS, QTH and zip code into the BBS user file, the software automatically assembles a message once a day containing all of the latest user information and sends it t the WD6CMU White Pages. Hank has now expanded the WP feature, an each BBS running the W0RLI software can now elect to opera it using the "P" command.
Each BBS however, continues to send a daily "WP" update of new or changed information to the WD6CMU White Pages. You can easily make use of the packet White Pages information, both at your local BBS and at WD6CMU.

If your BBS is operating with its own WP database, you may make inquiries of it using the "P" command. Simply enter P followed by the callsign you'd like information about. If you wanted information on WB9LOZ, for example, you would enter: P WB9LOZ.
[W0RLI BBS only!]

Information from the WD6CMU White Pages is obtained by sending a message to "WP @ WD6CMU". You can also update the database with new information. One message can contain several lines, including a combination of queries and updates. Since the messages are read and answered by the WP software, not a person, each line must have the correct format. One of the following formats must be used:

```
<callsign> QTH?
<callsign> @ <BBS> <zip code> <name> <QTH>
DE <callsign> @ <BBS>
```

The first form is a query. It will cause a message to be returned to you giving the home BBS, QTH and zip code of the person with the given callsign. If the information is not available from the WP database, the return message will tell you so. The second form adds or changes the entry for the given callsign, and the third form provides a return address for the requested information. Replies

will be sent to the originating station at the BBS specified. If the return address line is not given, the WP program will attempt to determine the originating station and BBS from the message headers.

Here are some examples of messages to the WD6CMU White Pages database: Suppose you wanted to know the home BBS of K9AT. You would send a message to WP like this:

```
(Your BBS) W6BBS>
SP WP @ WD6CMU
Enter title of message:
Query
Enter text:
K9AT QTH?
DE N6XYZ @ W6BBS
(Control Z)
```

Capital and lower case letters may both be used within the message.

If you wanted to update or add information to the White Pages, you would send a message like this:

```
(Your BBS) W6BBS>
SP WP @ WD6CMU
Enter title of message:
Update
Enter text:
N6XYZ @ W6BBS 94199 John San Francisco, CA
AD6ZZ @ WB6ABC 94015 Anne Daly City, CA
DE N6ZYX @ W6BBS
(Control Z)
```

When updating or adding an entry to WP, you should make sure that the information is accurate.

Here's an example of a message tht has both queries and updates:

```
(Your BBS) W6BBS>
SP WP @ WD6CMU
Enter title of message:
Update/Query
Enter text:
K9AT QTH?
WA6DDM QTH?
N6XYZ @ W6BBS 94199 John San Francisco, CA
AD6ZZ @ WB6ABC 94015 Anne Daly City, CA
DE N6ZYX @ W6BBS
(Control Z)
```

Just like all other packet messages, messages addressed to WP @ WD6CMU are forwarded from BBS to BBS toward their destination. When a message containing new or updated information passes through a BBS operating the W0RLI WP program, the software recognizes the WP format and extracts the information from the message for its database. The

W0RLI WP program also collects data from any WP responses it sees and from the message headers of every message that passes through. In addition, if a BBS operating with the W0RLI WP sees a query, it will respond with any pertinent information that it has available. As a result, you might receive more than one response to your WP query.

The information on each call in a W0RLI WP database is usually deleted in 60 to 90 days if it's not updated. This keeps each local database current and at a manageable size. The WD6CMU White Pages directory retains the data for a longer period of time.

It is important to note here that when you check into a new BBS, you should always enter the same information that you have at previous times. Choose ONE BBS as your home BBS, the one where you want all of your messages delivered, and enter that callsign every time you're asked. If you enter two or more different BBS calls at various times, your mail could end up being sent from BBS to BBS.

When a message arrives at the destination given in the "@ BBS" column, the latest software now checks the White Pages information to make sure the to the right place. If it finds
that you have a different BBS listed as your home BBS, it will insert the new BBS callsign and send the message on its way. You may never get it.

If you move or change your home BBS, you hhould then make sure that you update the information for your call in the White Pages database. If you use a BBS with W0RLI software, the BBS will send a WP message for you if you use the NH, NQ and NZ commands to update the information. If these commands aren't available on your BBS to make the changes, you'll have to send a message update yourself to WP @ WD6CMU. Making sure that the information in the White Pages is correct will help to get your messages delivered to the correct BBS.

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INTRODUCTION TO PACKET RADIO - PART 13
by Larry Kenney, WB9LOZ

In this article, let's do some reviewing. I'm going to present a short quiz on packet, covering the basics that I've presented in the past 12 columns. Let's see how well you can answer the following questions without looking back at the past articles. In Part 14, I'll discuss each question and give you the correct answers.

1. What are the three TNC modes of communication?
    a. Connect, Converse, Terminal
    b. Command, Converse, Terminal
    c. Command, Converse, Transparent
    d. Command, Connect, Transparent

2. What TNC command is used to set the transmit path for beacons and CQs?

3. What is the TNC command CHECK used for?

4. While you're connected to another station, what command is used to monitor other traffic on the frequency?

5. If you saw one of the following lines on your screen when in monitor mode, what would the asterisk indicate?
   W6ABC-3>N6XYZ,W6PW-1*: Hi Bob
   W6ABC-3>W6PW-1*>N6XYZ: Hi Bob
   (Displays vary with various TNCs, so both common types are shown.)

6. Why do the NET/ROM and TheNet nodes improve communications?

7. If you're connected to a station in New Mexico using NET/ROM or TheNet, how do you disconnect?

8. If N6ZYX-2 connected to you via a NET ROM or TheNet node, what would the SSID of the station become at your end of the connection?

9. When you're connected to another station, what are the two most probable causes for packets not to be received by the other station?

10. There are several basic commands used on a packet bulletin board system. Indicate what you would enter to perform the following:
    a. Receive a list of messages.
    b. Download a file in the General (ID G) directory called FCCEXAMS.89.
    c. Enter a private message to Jim, WA6DDM, who uses the W6PW BBS.
    d. Read message 7134 with complete headers.
    e. Find out what stations have been heard on port B.

11. To send an NTS message via packet addressed to Tom Smith, 123 Main Street, Keene, NH 03431, telephone (603) 555-4321, what would you enter at the BBS prompt?

12. If a message has a STATUS of BF, what does that indicate?

13. If you received a message from a friend in Chicago that had been forwarded to your home BBS through four other BBSs and the message had a Date/Time of 0316/2245 when you listed it, which of the following is a TRUE statement?
    a. The message was written at 2:45 pm on March 16.
    b. The message was entered into the BBS by your friend at 2245 on March 16.
    c. The message was forwarded by your friend's BBS in Chicago at

2245 on March 16.
   d. The message was received at your home BBS at 2245 on March 16.

14. If you wanted to send a message to your friend John, W4IP, but you didn't know what the call of his home BBS was, what could you do to try and find out what the call is?

15. BONUS: What is the maximum value for MAXFRAME? If you're working a station on 30 meters and are sending a lot of retries, should you increase or decrease MAXFRAME?

Well, how did you think you did? We'll take a close look at these questions and more in part 14 of this series.

INTRODUCTION TO PACKET RADIO - PART 14
by Larry Kenney, WB9LOZ

How did you do on the review quiz in the previous part of this series? If you haven't taken it, you might want to read part 13 and take the quiz before reading any further.

Here are the correct answers and the series part number where you can read more about the subject:

1 - Answer C is correct. The three TNC modes of communication are Command, Converse and Transparent. Command mode is for communicating with the TNC. The Converse mode is for normal QSOs, connects to a BBS or mailbox, etc. and Transparent mode is used for binary file transfer. (Part 2)

2 - The UNPROTO command is used for setting the transmit path for both beacons and CQs. (Parts 3 and 11)

3 - The CHECK command is used for setting a timeout value in your TNC. If set to a value other than zero, the TNC will attempt to recover a connection after a certain specified time if nothing is received from the other station. This command is used in combination with the AX25L2V2 command. (Part 11)

4 - The MCON command (Monitor while CONnected) is used to monitor other traffic on the frequency while you're connected to another station. (Part 4)

5 - When monitoring, the asterick indicates the station that you actually hear the packet from. The MRPT command must be ON for the monitor display to show digipeaters. (Part 4)

6 - NET/ROM and TheNet nodes improve communications because packets are acknowledged from your station to the first node, and then node to node to the destination. A packet doesn't have to reach the destination

before an ack is returned. (Parts 6 and 7)

7 - When using NET/ROM or TheNet (no matter who you're connected to) you disconnect by going to command mode on your TNC and sending a D, just like at other times. The fact that you're using several nodes or are connected to a distant station makes no difference. The network will take care of disconnecting all stations and links. (Parts 6 and 7)

8 - N6ZYX-2 would appear as N6ZYX-13 if he connects to you using a node. The nodes change the SSID using the formula 15-N. (Part 6)

9 - The two most probable causes for a packet not to get through are collisions with other packets on the frequency and noise due to weak signals. (Part 10)

10 - BBS commands:
  a. To receive a list of messages: L
  b. To download a file in the General (G) directory called FCCEXAMS.89, you'd enter DG FCCEXAMS.89
  c. To enter a private message to Jim, WA6DDM: SP WA6DDM @ W6PW (The "@ W6PW" is not needed if you're using the W6PW BBS.)
  d. To read message 7134 with headers: RH 7134
  e. To find out what stations were heard on port B of the BBS, you'd enter JB
 (Part 5)

11 - If you wanted to send a message to Tom Smith, 123 Main Street, in Keene, NH 03431, you would enter the following at the BBS prompt > ST 03431 @ NTSNH (Part 8)

12 - A message with a STATUS of BF means that the message is a bulletin and that it has been forwarded to all stations that are supposed to receive it from the BBS you're using. (Part 9)

13 - Answer D is correct. The date/time of a message is the time the message was received at the BBS you're using. Please note that the date/time of a message does not indicate local time, zulu time, UTC, GMT, or whatever. It indicates the time that that BBS is set to. Most BBSs are now set to zulu time (UTC, GMT), but many still use local time. When you reada message, you should be able to get the date and time the message was written from the message header. (Part 9)

14-To find the call of the HOME BBS of your friends, use the White Pages Directory. If the BBS you're using has the WP feature enabled, you will find the P command to be useful, otherwise send an inquiry to WP. (Part 12)

15-BONUS: The maximum value for MAXFRAME is 7. MAXFRAME is the number of packets transmitted by your TNC contiguously, and the number of unack-

nowledged packets the TNC can have outstanding. You decrease MAXFRAME when conditions are poor. Your TNC will send fewer packets at one time, so there will be less information to collide with other packets on the frequency and less chance of information being wiped out by noise. (Part 11)

There is no passing grade on the quiz. It was designed for you to check your general packet knowledge, and you'll have to be your own judge of that.

INTRODUCTION TO PACKET - Part 15
by Larry Kenney, WB9LOZ

W0RLI, N6VV, and VE3GYQ have devised a scheme called HIERARCHICAL ADDRESSING. With hierarchical routing designators we have an opportunity to improve traffic routing. No longer will a missing call in a BBS forwarding file cause a message to remain unforwarded, sysops will no longer have to burn the midnight oil trying to keep their forward files up to date, and messages will move much more directly toward their destination.

The format for hierarchical routing is:
  addressee @ BBScall.#local area.state-province.country.continent.

It might look complicated, but it's not. First, note that each section of the format is separated by a period. Codes used for the continents and countries are standards, now accepted throughout the world. You should be able to find a list of them in the file section of your BBS. State and province codes are the recognized two-character codes established by the American and Canadian Post Offices. These may be found in the Callbook, your phone directory, or any zip code listing. The code for local area or county is optional, since most of you have no idea what code is being used back in upper New York state or in Iowa City, IA. If you know it, use it, since it will help get the message closer to where it's going. The code for Northern California is #NOCAL, and the code for Southern California is #SOCAL. You should use the appropriate one in your signature line. For messages going outside of the US or Canada, the local area is optional and the state is eliminated.

Using the hierarchical format, here are some routing examples:

```
WB9LOZ @ W6PW.#NOCAL.CA.USA.NA
N6KZB @ KD6SQ.#SOCAL.CA.USA.NA
KC3XC @ N4QQ.MD.USA.NA
JA1ABC @ JA1KSO.#42.JPN.AS
VK4AHD @ AX4BBS.AUS.AU
```

You'll note that the local area code is preceded by the octothorpe #. (Now, how's that for a $5 word?) The reason is that the Japanese network, and possibly other areas, want to use routing numbers for the local area/county code, which could get confused with zip and postal codes. Using the # on all local area codes will eliminate forwarding

problems.

We need to emphasize two very important points: hierarchical addressing DOES NOT indicate a forwarding PATH, and ONLY ONE BBS call should be included in the address. A list of BBS calls separated by dots will not get your message to its destination. The addressing scheme is said to be one area inside another area. Using my hierarchical address as an example, WB9LOZ @ W6PW.#NOCAL.CA.USA.NA, here's how you would describe the address: "WB9LOZ at W6PW which is in Northern California which is in California which is in the USA which is in North America".

There are several BBS programs that implement hierarchical addressing now, including the W0RLI, AA4RE and WD6CMU software. Check the ID block you receive when you log into your BBS. If it has an H in it, such as [RLI-9.07-CH$] or [4RE-02.4-HM$], your system supports it.

This next section explains how the BBS software uses the hierarchical addressing scheme. We first have to understand how the software goes about matching items in the "@ BBS" address with items in the forward file. For an example, let's say that we send a message to Tom, W3IWI, who operates his own BBS and is located near Baltimore, Maryland. We would enter:

```
    SP W3IWI @ W3IWI.MD.USA.NA
```

If the only entries in the forward file are California BBSs plus a list of state abbreviations, let's see how the message would be forwarded. The first thing the software does is attempt to find a match between the items in the forward file and the left-most item in the address field. In our case, it would not find W3IWI. If there isn't a match, it then moves to the next section to the right. It would find MD and that match would allow the message to be forwarded. If it had found the call W3IWI, that entry would take precedence (because it is more left in the field than MD) and would of course also ensure delivery.

Here are some comments from the ones who devised the hierarchical addressing:

"There is another added benefit to this scheme. It involves Gatewaying between the BBS world and other networks, such as TCP/IP via SMTP. Much of the pioneer work in setting up the gatewaying protocols has been done by NN2Z, N3EUA, and PA0GRI, amongst others. The W0RLI BBS package allows for the forwarding of mail between the BBS world and the SMTP world. Of note is the fact that the WA7MBL package has allowed such message exporting and importing for some time now. This means that we can take advantage of the the TCP/IP host-names and their domain or hierarchical format for forwarding. Thus it is possible to send mail from the BBS to VE3BTZ as ve3btz@pc.ve3btz.ampr.org or from SMTP to w0rli@w0rli.ca.usa.na and not have any ambiguity.

"We expect that WA7MBL will also be implementing hierarchical routing in the near future. This system is still compatable with older style

systems, as a system that handles hierarchical forwarding identifies with the H feature letter: [RLI-8.00-CH$]. If it does not get an appropriate response, it uses the left-most item in the "@ BBS" string as the "@ BBS" for the message.

"The authors hope that this paper will serve as a starting place for improved message routing by means of implicit routing. Low-level (VHF) BBSs need only maintain state or province or country codes for distant BBSs, and route such traffic to their nearest HF Gateway. In turn, the HF station routes it to the desired state, where the receiving Gateway station would have a detailed list of the BBSs it serves."

Comments from W0RLI, N6VV and VE3GYQ.

INTRODUCTION TO PACKET RADIO - PART 16
By Larry Kenney, WB9LOZ

In the previous 15 parts of this series, this column has covered all of the basics of packet radio - from setting up your TNC and making your first QSO, to using digipeaters and Net/Rom. Many of the TNC commands have been explained, including the best settings for normal packet use. I have discussed the procedures used for logging into a packet Bulletin Board System or Mailbox, and have given you information on how to list, read and send messages, download and upload files, and use other features available. I've talked about the general message format, the reasons for limiting the number of digipeaters you use, calling CQ on Net/Rom and a variety of other topics.

More articles will be written as new developments are made and old features are updated. There are several programs available for making special use of packet, such as TCP-IP, Tex-Net and Conference Bridging, and high speed modems are just around the corner. Perhaps we'll take a look at those topics in the months ahead. Right now I'm not familiar enough with them to write about them. I'm interested in getting on the air with TCP-IP, so I might get into that next.

If you have any comments on this series, have any questions on the topics discussed, or want to suggest new topics for discussion in future articles, please leave a message for me. I hope that you've found this series to be informative and helpful in making packet more enjoyable.

73, Larry Kenney, WB9LOZ @ W6PW